FINAL

Groundwater Investigation Report

Eurus Energy, Borrego Solar Farm
APNs: 141-240-24, 141-230-26, 141-230-33
Palm Canyon Drive, Borrego Springs
San Diego County, CA

MUP 09-012, 09-013, 09-014; ER 09-05-001

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1.0 INTRODUCTION

1.1 Purpose of Report

The purpose of this report is to meet the groundwater investigation requirements of the San Diego County Groundwater Ordinance. This investigation provides a summary of groundwater resources within the Borrego Valley aquifer to determine if these resources are capable of meeting the project water demand.

Section 67.720 of the Ordinance specifies that for any proposed project listed in Section 67.711 within the Borrego Valley Exemption Area which either (1) includes a water-intensive use (greater than 20 acre-feet of groundwater per year), or (2) consists of a total project area of 100 acres or more, shall be accompanied by a Groundwater Investigation. Due to the proposed project's size being greater than 100 acres, a groundwater investigation is required for the project. The proposed project will not be approved unless the approving authority finds that based upon the Groundwater Investigation, groundwater resources are adequate to meet the groundwater demands of the project.

1.2 Project Location and Description

Project Location:
Desert basins account for approximately 14% of the unincorporated area of the County and are located in the extreme eastern portions of the County as shown on Figure A-1. Desert basins are characterized by extremely limited groundwater recharge, but typically large storage capacities. Based on these characteristics, groundwater pumping that exceeds the limited rate of recharge results in a groundwater overdraft condition, which is not sustainable for long-term groundwater use.

The project is a total of 350 acres located on three separate parcels (Assessor Parcel Numbers 141-240-24-00, 141-230-26-00, and 141-230-33-00). The project sites are located on Palm Canyon Drive in the Borrego Springs Community located within the Desert Subregional planning Area within unincorporated San Diego County. The site overlies the Borrego Valley aquifer as shown on Figure A-2. Borrego Valley lies within the Colorado Desert geomorphic province just to the east of the mountainous terrain of the Peninsular Ranges geomorphic province.

Project Description
The project is three Major Use Permits to authorize a Major Impact Utility Pursuant to Section 1350 of the Zoning Ordinance. The project consists of a 42 Mega watt Unmanned Photovoltaic Solar Farm and an associated 69Kv Generation Tie Line (Gen-tie). The Gen-Tie route location is yet to be determined. The proposed Gen-Tie will run from the Solar Farm Parcels, to the existing 69Kv Borrego Substation, which is operated by SDG&E. The project will obtain imported groundwater from the Borrego Water District. No sewer service is required because the facility would be unmanned. The grading will consist of a balanced grade of approximately 210,000 cubic yards of total

excavation. The project does not propose any offsite improvement except for the extension of the water lines to the project parcels.

Proposed Groundwater Demand

During the initial construction phase of the project, which includes brushing, clearing, grading, road construction, foundation construction, and panel installation, the applicant has indicated approximately 16 acre-feet of imported groundwater will be required. This is anticipated to occur within a 10-month period.

For the remaining life of the 30-year project, the applicant has indicated approximately 3 acre-feet per year of imported groundwater from the Borrego Water District will be required for cleaning of the solar panels and dust suppression. Additional details of water demand for this project can be found within the project description provided by the applicant on file with DPLU under Environmental Review No. 09-05-001.

2.0 EXISTING CONDITIONS

2.1 Physical Setting

2.1.1 Topographic Setting

The project site is located at the base of the Henderson Canyon drainage on an alluvial fan. The lot varies in elevation from greater than 525 feet above mean sea level (ft MSL) on the southern boundary to 545 ft MSL in the northwestern boundary. Borrego Valley covers an area of approximately 110 square miles and ranges in elevation from approximately 1,100 to 1,200 ft MSL around the margins of the aquifer to approximately 450 ft MSL within the vicinity of Borrego Sink (see Figure 2). Approximately 400 square miles of tributary watershed from multiple intermittent creeks and streams drain from the mountains into Borrego Valley, which provide the primary source of groundwater recharge to the Borrego Valley aquifer. The largest surface water inflow occurs along the Coyote Creek drainage entering into the northern portion of Borrego Valley. Another important drainage is Borrego Palm Canyon, where surface water enters into the western portion of the valley.

2.1.2 Climate

Borrego Valley has an arid climate with precipitation averaging approximately 3 to 6 inches in the center of the valley and 6 to 9 inches along the western margins of the valley. Precipitation in the mountainous regions located west of Borrego Valley average from 15 to over 21 inches annually. On average, over 75 percent of the annual precipitation occurs between November and May, and less than 25 percent of the annual precipitation occurs from summer rain and thunderstorms that typically occur from July through September. Temperatures are very hot during the summers with average high temperatures exceeding 105 degrees F, and winters are cool with average lows below 40 degrees F.

Monthly reference evapotranspiration (ETo), which is a measure of potential evapotranspiration (PET) from a known surface such as grass or alfalfa, has been estimated for Borrego Valley to be approximately 71.6 inches per year (DWR, 1999). The ETo rates are highest in July at 9.6 inches, and are lowest in December at 2.2 inches.

2.1.3 Land Use

The land uses in Borrego Valley primarily include residential, agricultural, recreational, and commercial uses. Most of the land is owned by private individuals or corporations. The majority of agricultural lands are located in the northern portion of Borrego Valley. The Anza Borrego Desert State Park and other parkland cover some of the margins of Borrego Valley and the mountain regions above Borrego Valley. Borrego Springs is completely surrounded and encompassed by State park land which also includes Indian, private, and National forest land.

Existing Residential Land Use: As of 2005, there were roughly 2,500 existing residential units in Borrego Valley. From January 2001 through June 2008, the County processed 318 residential building permits for manufactured and stick built homes (both custom and mass produced). During that time, an average of 42 residential building permits was processed per year. As of January 2007, there were approximately 3,725 existing, private unbuilt parcels in Borrego Valley. Of these, roughly 85% (approximately 3,166 parcels) are estimated to have legal lot status (County of San Diego, 1999). Having a legally created lot which meets Zoning requirements still may not be buildable due to a number of factors such as floodplain issues, having legal access to roadways, having access to sewer or water, etc. Building permits are granted on a case-by-case basis by the County, and it is not possible to accurately estimate the number of legally buildable parcels in Borrego Valley. However, the significant inventory of existing unbuilt lots could possibly provide an additional 3,000+ future residential units without any additional subdivision.

Current General Plan and General Plan Update Residential Land Use: Below is a table which provides the maximum allowable additional residential units permitted by the current General Plan as well as those proposed by the General Plan Update Referral Map:

Current General Plan Map	General Plan Update Referral Map
19,466	8,689

2.2 Hydrogeologic Setting (Existing Conditions)

2.2.1 Hydrogeologic Units

The United States Geological Survey (USGS) estimates that Borrego Valley is underlain with up to 2,400 feet of consolidated to unconsolidated sediments resting on basement granitic rocks. In 1982, the USGS estimated at steady-state groundwater conditions (in the year 1945), the Borrego Valley groundwater basin contained approximately 5.5 million acre-feet of water in storage. Further, the USGS identified three Hydrogeologic units: an upper, middle, and lower aquifer (Moyle and others, 1982; Mitten and others, 1988). In 1988, the USGS prepared a numerical model of the aquifer. The results of the model suggest that the specific yield of the upper, middle, and lower aquifers are 14%, 7%, and 3%, respectively.

Based upon subsequent study by Dr. David Huntley, the majority of readily available water to existing well users in the Borrego Valley exists in the upper and middle aquifer. The amount of groundwater within these two aquifers was estimated to be approximately 2,131,000 acre-feet in 1945 and 1,900,500 acre-feet in 1979 (Huntley, 1993). The remaining water located within the lower aquifer is more difficult and costly to extract due to its low specific yield (estimated to be approximately 3%), its depth, and low specific capacity (estimated to be 5 gallons per minute/foot of drawdown or less). The

Borrego Water District estimated that in 1999 the water remaining in the upper and middle aquifers was approximately 1,685,000 acre-feet (BWD, 2001).

The USGS is conducting a new phase of groundwater investigative work in Borrego Valley projected to be completed in 2010. The objective is to refine their 1980s groundwater flow model to take advantage of flow modeling tools not available in their 1988 numerical model. The model will be used as a predictive tool to estimate the amount of time left before the groundwater table drops below the pump intake in production wells currently being used in Borrego Valley. This should provide a more specific estimation of future groundwater impacts than previous studies conducted.

2.2.2 Water Quality

In general, water quality has historically been good within Borrego Water District's wells with total dissolved solids at concentrations of less than 500 mg/L (BWD, 2001). Historical nitrate impacts have been noted as evidenced by wells taken out of production including Borrego Water District ID-4 wells 1 & 4, and the Roadrunner Mobile Home Park well.

High salinity, poor quality connate water is thought to occur in deeper formational materials of the aquifer as well as shallow groundwater in the vicinity of the Borrego Sink in the southern portion of the Borrego Valley. Since there have been no comprehensive studies of water quality within Borrego Valley, it is difficult to assess the amount of potable groundwater still available in Borrego Valley. Water quality impacts may occur as decreased water levels may induce flow of poor quality water found in deeper formational materials of the aquifer. This may eventually necessitate additional expensive treatment of groundwater to make the water suitable as a drinking water supply.

Drilling of a dual screened monitoring well by DWR in the southern portion of Borrego Valley (northeast of Borrego Sink) provides confirmation of poor water quality in shallow groundwater and deteriorating with depth (DWR, 2007). Water analyzed from the upper completion (45 to 155 feet below ground surface) indicated total dissolved solids (TDS) of 1,300 mg/L. Water analyzed from the lower completion (200 to 345 feet below ground surface) indicated TDS of 2,300 mg/L. The high TDS content in both screened intervals of this well (as well as high sulfate content) make the water unsuitable for a drinking water supply without expensive treatment.

2.2.3 Groundwater Recharge

<u>Estimated Recharge</u>
Estimated annual recharge to the Borrego Valley aquifer was initially estimated by the USGS to be approximately 4,800 acre-feet per year (Mitten and others, 1988). The source of recharge was estimated to come primarily from three major drainages: Coyote Creek (approximately 65%), Borrego Palm Canyon and San Felipe Creek (approximately

35% combined). Little recharge, if any from San Felipe Creek benefits users in Borrego Springs as the majority exits Borrego Valley and flows toward Ocotillo Wells.

In a thesis by Netto in 2001, it was estimated that from 1945 to 2000, recharge from groundwater underflow, stream recharge, and bedrock recharge is approximately on average 5,670 acre-feet per year. In a thesis by Henderson in 2001, it was estimated that recharge from 1945 to 2000 averaged approximately 6,170 acre-feet per year. Both estimates showed that recharge had a very large range due to the extremes in rainfall, from very little during dry years to recharge above 50,000 acre-feet in the wettest year.

Age of Groundwater from Borrego Water District Wells

The Borrego Water District in 2001 obtained the age of the water being pumped in two of their pumping wells, well ID 4-11 and well ID 4-18. Analytical results from water sampled from well ID 4-11 indicated the water to be 873 years old (+- 42 years), and results from water sampled from well ID 4-18 indicated the water to be 1,982 years old (+- 54 years). The results indicate that water in these wells was from not from recent groundwater recharge, but rather from water that percolated and was recharged many hundreds of years ago.

2.2.4 Groundwater Demand

The Borrego Water District has estimated the amount of water used within Borrego Valley from 1950 to 2007. The most recent datasets from 1999 and 2007 were estimated using records of metered water use for municipal purposes, inspection of irrigated acreage of agricultural land, and reports from golf course operators. While groundwater demand more than doubled from 1978 to 1999, it appears that overall water usage may have leveled off between 1999 and 2007.

Year	Municipal (AFY)	Agricultural (AFY)	Golf Course and Landscape (AFY)	Total (AFY)
1950	170	11,435	190	11,795
1958	225	22,455	790	23,470
1962	265	13,455	1,725	15,820
1968	475	7,260	1,720	9,455
1972	530	5,320	2,270	8,120
1978	600	5,705	2,050	8,355
1980	430	10,600	2,100	13,130
1999	2,272	15,590	4,435	22,297
2007	1,920	14,650	5,240	21,810

AFY – Acre-feet per Year

2.2.5 Groundwater Levels

Groundwater levels in Borrego Valley were originally monitored by the USGS as far back as the 1940s. The County of San Diego has been collecting groundwater level data since the early 1980s. Water levels in Borrego Valley have been declining since 1945, indicating a long-term overdraft condition.

Between 1945 and 1980, water levels declined by as much as 100 feet, due to more water being extracted than was being replenished (USGS, 1982).

To provide an understanding of water level trends since the 1980s, water levels from eight wells (see Figure A-3 for locations) monitored by the County are summarized in the table below.

Well	Period of Monitoring	Cumulative Drawdown (feet)	Average Change in Water Levels (feet per year)		
			1980s	1990 to 1997	Since 1998
Borrego1	1983-2002	30.6	-1.1	-1.7	-2.3
Empty Irrigation	1987-2006	47.2	-1.5	-2.3	-3.2
Fortiner	1983-2006	55.6	-0.6	-3.4	-3.1
Levie	1986-2005	38.9	-1.0	-2.2	-2.4
State Park 2	1987-2006	49.8	-2.4	-2.2	-3.3
UEC North	1985-2006	26.7	-1.2	-0.5	-2.1
UEC South	1984-2006	24.0	-1.3	-0.5	-2.1
Victor	1983-2001	15.3	-0.9	-0.7	-1.1
AVERAGE OF ALL WELLS			**-1.2**	**-1.7**	**-2.4**

Since the 1980s, water level declines in the 8 wells have ranged from 15.3 feet (Victor well) to 55.6 feet (Fortiner well). From 1998 to 2006, water level declines have averaged 2.4 feet per year, which is roughly twice the rate of decline measured in the 1980s. This is likely due to the increased extraction rates that are occurring compared to extraction in the 1980s.

It has been estimated that the volume of groundwater in storage decreases with depth in Borrego Valley. Therefore, it is estimated that basin-wide rates of water level decline will increase with ongoing groundwater mining, even without any change in the deficit between groundwater extraction and recharge.

2.2.6 Groundwater Overdraft Condition

Since 1945, water levels in Borrego Valley have continually declined in some cases by as much as over 150 feet. Groundwater has and is continuing to be extracted at rates that exceed recharge, which has caused an apparent long-term overdraft condition, also known as groundwater mining. In the past 20 years, rates of decline have increased sharply likely in response to new development and additional groundwater extraction. Dr. Tim Ross of the California Department of Water Resources has estimated the overall rate of overdraft in the aquifer through time as follows:

1980-1989: -4,200 acre-feet per year
1989-2000: -9,100 acre-feet per year
1998-2005: -14,300 acre-feet year
It was estimated that a total of 550,000 acre-feet of water was permanently removed from the aquifer from 1945 to 2005 (Ross, 2006).

The Borrego Water District estimated that in 1999 the water remaining in the upper and middle aquifers was approximately 1,685,000 acre-feet (Borrego Water District, 2001). Based upon this estimation of groundwater storage in 1999, if the overdraft condition continues at the estimated rate of 14,300 acre-feet of water per year, the upper and middle aquifers may be 50% depleted in approximately 50 years, and may be completely depleted in approximately 100 years. These numbers, however, should be used with extreme caution, as there are a number of factors that are not fully known regarding the Borrego Valley aquifer. Groundwater pumping has more than tripled since the 1980s, and continued development without groundwater mitigation measures in Borrego Valley will exacerbate the existing overdraft conditions estimated by Dr. Ross.

It should be understood that groundwater impacts from the overdraft condition are already occurring and will continue to worsen as mining of groundwater continues. Current impacts include dry wells, decreased well efficiency and increased pumping costs as water levels continue to decline. This will continue and more wells will need to be replaced as water levels drop below perforated levels. Also, water quality impacts may occur as decreased water levels may induce flow of high salinity, poor quality connate water found in deeper formational materials of the aquifer. This may eventually necessitate additional expensive treatment of groundwater to make the water suitable as a drinking water supply.

The General Plan Update Referral Map (project) would allow for up to 8,689 additional residential units which would be anticipated to use approximately 8255 acre-feet of groundwater per year (0.95 acre-feet per residential unit). Without mitigation, this would increase the overdraft condition to over 22,000 acre-feet per year and the aquifer would be depleted in far less time compared to existing conditions groundwater use. However, based on recent development trends, buildout in the 21st century is unlikely, unless development trends in Borrego Valley change drastically. Between January 2001 and June 2008, approximately 42 residential building permits were processed per year by the

County. At this rate of development, it would take approximately 200 years for build-out to occur.

3.0 SUMMARY AND CONCLUSIONS

As documented within this report, the Borrego Valley aquifer has a well documented groundwater overdraft condition, where year after year groundwater extraction exceeds the amount of groundwater that is recharged back into the aquifer. In the long-term, this situation is not sustainable. The most recent estimate indicates that 14,300 acre-feet of water are being permanently removed from the aquifer per year and that the overdraft condition is worsening with time as groundwater extraction in Borrego Valley increases. It is also estimated that as water levels continue to drop, the rate of decline will increase since groundwater in storage is estimated to decrease with depth. It was estimated that in 1999, the upper and middle aquifer still contained approximately 1,685,000 acre-feet of groundwater in storage. Based upon the current estimated amount of groundwater in storage and existing estimated amount of overdraft as documented in this report, the upper and middle aquifer may be fully depleted in a little over 100 years. However, since the 1980s the groundwater overdraft condition has more than tripled, and additional groundwater use without groundwater mitigation will likely cause the overdraft condition to worsen and the aquifer to be depleted in far less time.

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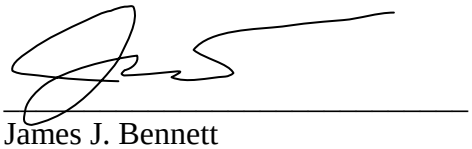
5.0 LIST OF PREPARERS AND LIMITATIONS

This report provides a summary of current groundwater conditions in Borrego Valley to meet the requirements for a Groundwater Investigation as required by the San Diego County Groundwater Ordinance.

The report was prepared based on best available information from groundwater investigations conducted by the USGS, DWR, and others. Future hydrogeological investigations conducted in Borrego Valley may result in revisions to previous estimates made of the estimated groundwater remaining in storage and the overall rate of overdraft occurring. At the current rate of overdraft estimated by DWR and especially if overdraft conditions continue to increase as it has within the past 25 years, the decline in water levels will continue to result in increasing costs to pump water and dry wells. It is possible that impacts including, but not limited to, dry wells and potential water quality degradation from high salinity water within deeper formational deposits may occur in Borrego Valley within the next 20 to 30 years.



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James J. Bennett Date

California Certified Hydrogeologist, #854, Expires 4/30/2012

California Professional Geologist #7707, Expires 4/30/2012

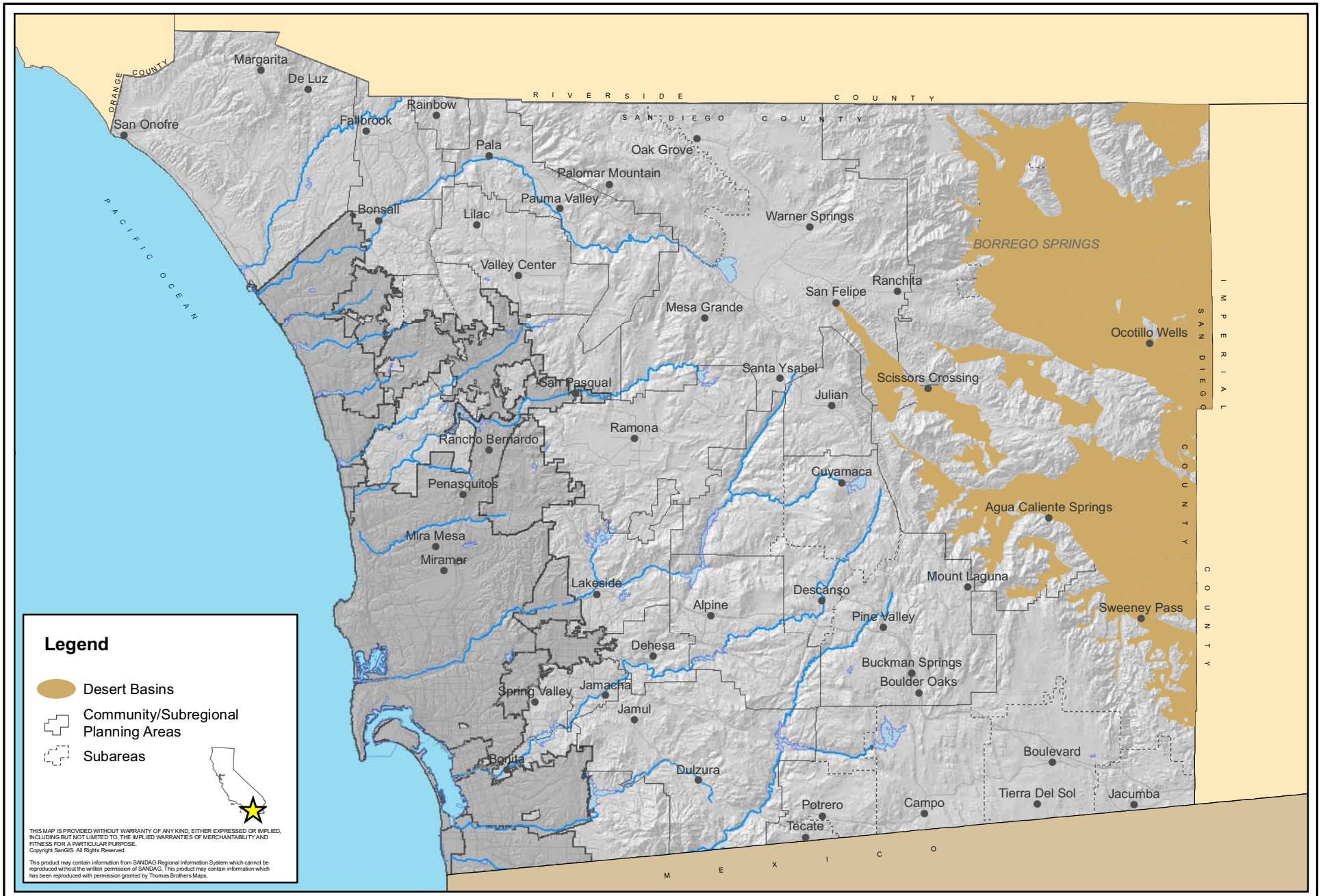

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Figure A-1
Desert Basins

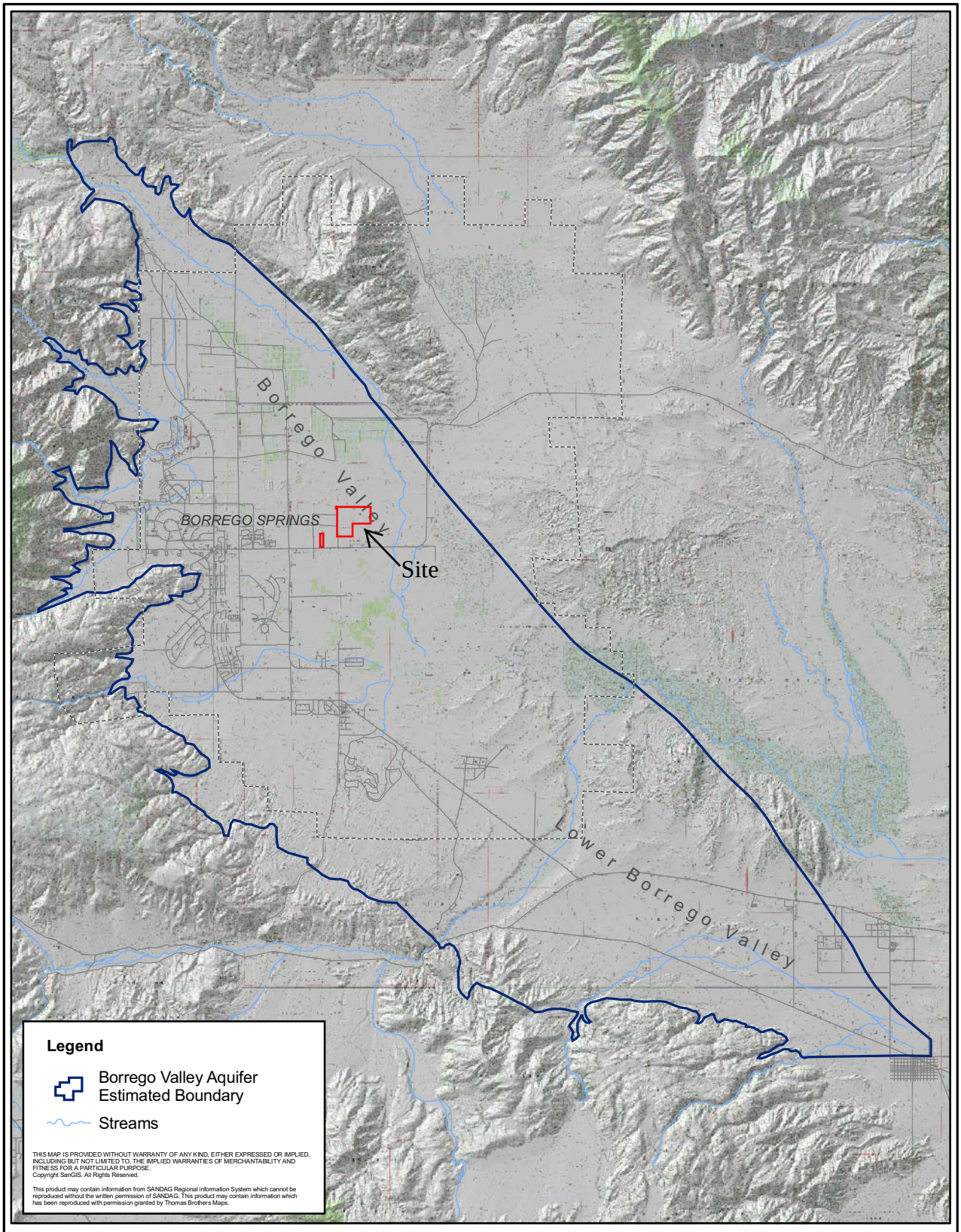
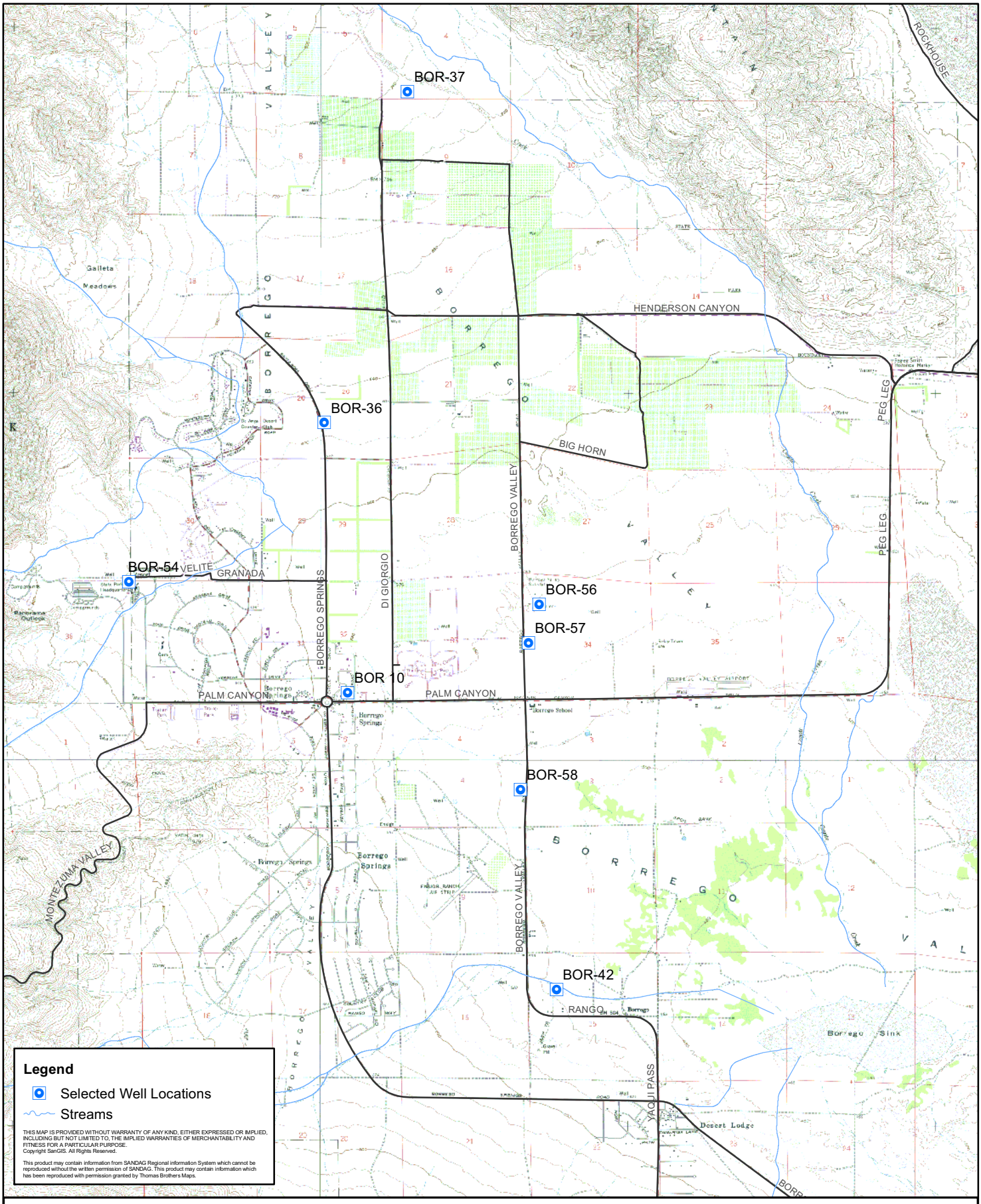


Figure A-2
Borrego Valley Aquifer



County Monitoring Wells
Borrego Valley
Figure A-3